SUBPART C - DAMS

MO 520.21 Definitions and Classes

NRCS is required by policy and federal law to maintain the National Inventory of Dams. Timely reporting of dam construction is important in developing and managing the engineering workload and workforce in the state. NRCS is currently participating as an advisor to the State Dam Safety Council as they look at revising registration criteria. Accurate and complete data on which to base decisions is needed.

(f) For the purpose of the National Inventory of Dams (NID) criteria contained in NEM 520.21(f)(2) and (f)(3) the definition of storage is the total volume capacity, in acre-feet, in a reservoir below the lowest planned settled crest elevation of the top of dam. This is the definition used by the U.S. Army Corps of Engineers for the NID.

(f)(4) Inventory dams will be included in the NRCS inventory if they meet all of the following:

(i) Dam was built with NRCS technical and/or financial assistance.
(ii) The dam was built according to NRCS standards and specifications in effect at the time of construction.
(iii) Alterations to the dam since the time of construction have been made in accordance with NRCS standards and specifications.

(f)(5) Inventory for new dams.

As new dams are constructed, the required data is to be added to the NRCS inventory on the basis of design and construction records. The individual approving the design shall, to the extent possible, complete Form MO-ENG-C94. The individual making the final construction check will check Form MO-ENG-C94, make any needed as-built corrections, and verify that all items are complete. One copy of Form MO-ENG-C94 is to be forwarded through the area office to the State Conservation Engineer and one copy retained in the case file.

State inventory information will be sent to the Missouri Department of Natural Resources at least annually, by the State Office.

Inventory data will be retrieved as needed by the State Office and copies of the inventory furnished to respective area and field offices.

Data on new dams and updated or corrected data on previously submitted dams can be submitted at any time. Data on all dams completed the past year from September 1 through August 31 must be forwarded through the area office to the State Conservation Engineer by September 30. This data will then be entered into the dam inventory database.

(f)(6) Responsibility.

(i) The State Conservation Engineer provides overall coordination for the inventory of dams.

(ii) Each Area Conservationist (AC) insures the inventory policy is carried out by the field offices.

(iii) Each area office will review the data for each dam received from the field, for completeness and accuracy, before transmitting to the state office.

Instructions for completing Form NRCS-ENGC-94:

All instructions are on form or self explanatory except the Federal Agency I.D. (NRCS I.D.). Additional instructions are contained in Missouri Engineering Forms Handbook. The NRCS I.D. is a 10-character Missouri NRCS identification in accordance with the following:

(i) Watershed Dam - This identification begins with the 2-letter (MO) state abbreviation, followed by a **4-digit project number for the watershed**, followed by 4-digit site number.

Example: Troublesome Creek, Site A5
MO**2025**A005

(ii) CO-01 Dam - This identification begins with a 2-letter (MO) state abbreviation, followed by a **2-digit program code (01)**, followed by a *3-digit county* number, followed by a 3-digit site number.

Example: Joe Doe in Atchison county and 14th site in county
MO**01***005*014

(iii) RC&D Dams - This identification begins with the 2-letter (MO) state abbreviation, followed by a **4-digit project number**, followed by a 4-digit site number. The site number will be consecutive starting with 0001.

Example: Dam in Green Hills RC&D Project, 3rd dam in project
MO**6003**0003

NRCS NATIONAL INVENTORY OF DAMS (for Missouri use)

1) DAM NAME: _____

2) Other Dam Names: _____ 3) Dam Former Names: _____

4) Federal Agency ID (NRCS ID): _____ 5) National ID: (Provided by MO Dam Safety)

6) Longitude: (Decimal Degrees) _____ 7) Latitude: (Decimal Degrees) _____

8) Location: S____ T____ R____ 9) County:_____ 10) River/Stream: _____

11) Nearest City/Town:[1/] _____ 12) Distance to Nearest City/Town: _____Miles

13) Owner Name: _____ 14) Owner Type:[1/] _____ 15) Dam Designer: _____

16) Non-Fed Dam on Fed Prop:☐Yes ☐No 17) Dam Type:[1/] _____

18) Dam Core: Position: ___ Type: ___ Certainty:___ 19) Foundation: Material: ____ Certainty: _____

20) Purpose:[1/]_____ 21) Year Completed:_____ 22) Year Modified: _____

23) Dam Length, Ft.:_____ 24) Dam Ht., Ft.:[1/]_____ 25) Structural Ht., Ft.:[1/]_____ 26) Hydraulic Ht., Ft.:[1/]____

27) Maximum Discharge, cfs:_____ 30) Surface Area, AC:_____

31) Drainage Area, Sq. Mi.: _____ 32) Down Stream Hazard: ☐ L ☐ S ☐ H

33) Emergency Action Plan (EAP): ☐Yes ☐No ☐Not required 64) EAP Year: [1/] _____

34) Last Inspection Date:_____ 35) Inspection Freq.: (Yrs) ___ 36) State Regulated Dam: ☐Yes ☐No

37) State Regulatory Agency: _____ 38) Spillway Type: ☐Uncontrolled ☐Controlled ☐None

39) Spillway Width, Ft.:_____ 40) Outlet Gates:[1/] _____ 41) Volume of Dam, CY:_____

42) Number of Locks: _____ 43) Length of Locks: _____ 44) Lock Width: ___

Federal Agency (USDA NRCS) Involvement

45) Involvement w/Funding: ☐Yes ☐No 46) Involvement w/Design: ☐Yes ☐No

47) Involvement w/Construct: ☐Yes ☐No 48) Involvement w/Regulatory: ☐Yes ☐No

49) Involvement w/Inspection: ☐Yes ☐No 50) Involvement w/Operation: ☐Yes ☐No

51) Involvement as Owner: ☐Yes ☐No 52) Involvement w/Others: ☐Yes ☐No

53) Authorization: ☐CO-01 ☐PL-566 ☐RC&D ☐WP-03 ☐PILOT ☐OTHER

54) PL566 Watershed #: _____ 55) PL566 Watershed Name: _____

56) Planned Service Life (Yrs): ____ 57) O&M Inspection Responsibility[1/]: _____ 58) O&M Current ☐Yes ☐No

59) O&M Completed: ☐Yes ☐No 60) Population at Risk[1]: _____ 61) Population at Risk Accuracy[1/]: _____

62) Hazard Classification as Designed or Modified: ☐ L ☐ S ☐ H 63) Hazard Classification Year: _____

65) Sediment Storage, AC.FT.:[1/]_____ 66) Flood Storage, AC.FT.:[1/]_____

67) Surcharge Storage, AC.FT.:[1/]_____ 68) Other Storage, AC.FT.: _____

69) Principal Spillway Type: ☐Concrete Pipe (CP) ☐Open Concrete (OC) ☐Corrugated Metal Pipe (CM) ☐None (NO) ☐Concrete Box (CB) ☐ Welded Steel (WS) ☐Plastic (PT) ☐Other (OT)

70) Auxiliary Spwy #1 Type:_____ Codes: VE - Vegetated RK - Rock ST - Structural

71) Auxiliary Spwy #2 Type:_____ EA - Earth OT - Other NO - None

72) Auxiliary Spwy #3 Type:_____ HR – Hard Rock SR – Soft Rock

73) Conduit Height/Dia:_____Ft. 74) Conduit Width:_____Ft. 75) Number of Conduits:_____

76) Cool Water Release: ☐Yes ☐No

[1/] SEE BACK FOR CODE DEFINITIONS

Permit No. To Construct: _____ Permit No. To Operate: _____

Remarks: _____

_____

[1/] DAM INVENTORY CODE & DEFINITIONS

Owner Type (14)
F – Federal
S – State
L – Local Government (PL-566)
U – Public Utility
P – Private Owner

Foundation (19)
Material: R – Rock
RS – Rock & Soil
S – Soil
U – Unlisted/Unknown
Certainty: K – Known
Z – Estimated

Type of Dam (17)
RE – Earth
ER – Rockfill
PG – Gravity
CB – Buttress
VA – Arch
MV – Multiarch
CN – Concrete
MS – Masonry
RC – Roller Compacted Concrete
ST – Stone
TC – Timber Crib
OT – Other

Core (18)
Position: F – Upstream Facing
H – Homogenous Dam
I – Core
X – Unlisted/Unknown
Type: A – Bituminous Concrete
C – Concrete
E – Earth
M – Metal
P – Plastic
X – Unlisted/Unknown
Certainty: K – Known
Z – Estimated

Purposes (20)
I – Irrigation
R – Recreation
T – Tailings
D – Debris Control
C – Flood Control
P – Fire Protection
S – Water Supply
F – Fish & Wildlife
O – Other
G – Grade Control

Year Modified (22)
S – Structural
F – Foundation
E – Seismic
H – Hydraulic
M – Mechanical
O – Other

Outlet Gates (40)
X – None
L – Vertical Lift
S – Slide
U – Uncontrolled
F – Flap
V – Valve
O – Other Controlled

O&M Inspection Respon. (57)
OWNER (if same as field 13)
JOINT (for Owner & NRCS)
NRCS
OTHER
NONE (No O&M Agreement)

Population At Risk Accuracy (61)
E – Estimated
A – Analyzed Breach Map

Downstream Hazard (32)
Hazard Classification (62)
L – Low (NRCS Class a)
S – Significant (NRCS Class b)
H – High (NRCS Class c)

(11) Nearest City or Town - Nearest downstream community affected if breach were to occur

(12) Distance To Nearest City/Town - Stream miles to affected town

(24) Dam Height - Top of dam to downstream toe (nearest ft.)

(25) Structural HT. - Top of dam to lowest point of excavated foundation

(26) Hydraulic HT. - Maximum design water level to downstream toe

(60) Population At Risk – All persons exposed to breach flood waters if no evacuation

(64) EAP Year: - Year of most recent review and verification of existing or implementation of new EAP

(65) Sediment Storage - Considered as the volume below the principal spillway elevation

(66) Flood Storage - Volume between principal and auxiliary spillways

(67) Surcharge Storage - Volume between auxiliary spillway and top of dam

§MO520.23 Classification

(b)(1) It is important that reasons for assigning a classification be documented. Documentation of the classification is to be one of the following:

(i) For non-inventory size Class “a” dams in rural areas with low potential for development, complete Form MO-ENG-46, MO-ENG-C46, or Form MO-ENG-C82.

(ii) For non-inventory size Class “a” dams in developing areas use Form MO-ENG-C82. All dams in the following counties with high potential for development shall use Form MO-ENG-C82:

Boone, Buchanan, Camden, Cape Girardeau, Cass, Clay, Cole, Franklin, Greene, Jackson, Jasper, Jefferson, Platte, St. Charles, St. Louis, and Taney.

(iii) For all job Class IV dams, all Class “a” inventory size dams and all Class “b” and “c” dams, complete Form MO-ENG-C82. A USGS map or equivalent shall be included to show site location and downstream hazards.

(iv) Written notes addressing all items to be included in the classification documentation may be used for all dams in lieu of the forms.

(2) Attached is a copy of form MO-ENG-C46 and MO-ENG-C82.

DOCUMENTATION FOR HAZARD CLASSIFICATION OF DAMS

(PL-566, Job Class IV and Inventory Dams) [1/ 4/ 5/]

Name or Number of Site _____

Program (Check One): ☐ Watershed; ☐ RC&D; ☐ CO-01

Location: (See attached map or photo)

County _____ Section No._____ T_____ R_____

Dam in Series: ☐ Yes ☐ No Explain: _____

_____

Preliminary Structure Data

_____ Assumed Hazard Class [2/]

Drainage Area:_____Acres

A. Ditch Bottom Elevation at Centerline_____

B. Ditch Bottom Elevation at Downstream Toe_____

C. Floodplain Elevation at Centerline_____

D. Settled Top of Dam Elevation_____

E. Auxiliary Spillway Crest Elevation_____

F. Total Storage to A.S. Crest_____Ac-Ft.

G. Effective Height: E. – A. = _____

H. Overall Height: D. – B. = _____ [3/]

H x S: G. x F. = _____

Conduit Diameter: _____inches

Job Class_____(See Form MO-ENG-C12 or C12A)

Downstream Conditions

1. Valley Conditions Downstream from Structure: ☐ Convergent ☐ Divergent ☐ Parallel

   Floodplain Elevation _____ Valley Slope in Downstream Direction _____

2. Stream Channel Size: Depth _____ Width _____ Valley: Width _____ Shape_____

3. Valley Roughness or Retardance: "n"_____

4. First Downstream Hazard (See Page 2 of 2) _____ Distance _____

5. Distance Downstream to Junction of Significantly Larger Tributary _____

Rationale for Determining Hazard Class _____

_____

_____

_____

Actual Hazard Class _____ Analyzed by _____ Date _____

Approved by _____ Date _____

ATTACHED: Breach Routings ☐ Yes ☐ No
Map(s)
Other pertinent supporting documents

Describe Type of Utilities, Distance Downstream and Distance Above Floodplain Elevation	Approximate Distance Downstream From Dam	Approximate Distance Above Floodplain Elevation	Location in Potential Impact Area (Yes or No)
Building and Utilities:			
Roads and Railroads:			
Bridges:			

Describe Potential Downstream Development: _____

_____

_____

Potential impact area due to sudden failure of dam:

☐ Determined by breach routing. (See attached maps and/or other descriptions)

☐ Taken from Tech. Note 9:

H_{BR} = Auxiliary Spillway Elevation – Floodplain elevation

= _____ - _____ = _____ ft.

A = Area of dam above floodplain elevation = _____ sq. ft.

V_S = F = _____ ac. ft.

$$BR = \frac{V_S H_{BR}}{A} = \frac{\_\_\_\_ \times \_\_\_\_}{\_\_\_\_\_} = \_\_\_\_\_ \text{ ac.}$$

$Q_{max} = 1100\ BR^{1.35}$ = _____ cfs. Use _____ cfs

Distance Downstream (ft)	0	500	1,000	1,500	2,000	2,500	3,000	5,000	7,500	10,000	15,000
Water Depth (ft)	H_{BR}										
Q (cfs)	Q_{max}										

The hazard classification and design should be re-evaluated if there is development or changes in the impact area or upstream watershed.

NOTE:

[1/] Inventory dams are described in NATIONAL INVENTORY AND MONITORING MANUAL, Part 505, MO505.05 and NATIONAL ENGINEERING MANUAL 520.21(f).
(All class b and c dams.
All class a dams with 6 feet overall height and storage of 50 or more acre-feet.
All class a dams with 25 feet overall height and storage of 15 or more acre-feet.)

[2/] Definition of hazard classification in NATIONAL ENGINEERING MANUAL 520.21.

[3/] See Rules and Regulations of the Missouri Dam and Reservoir Safety Council if overall dam height is greater than 35 feet.

[4/] See NATIONAL ENGINEERING MANUAL Supplement MO 520.23 and MO 520.28.

[5/] This form may also be used for non-inventory size dams.

Landowner: _____

Address: _____ Field No. _____

Designed by: _____ Date: _____ Checked By: _____

HAZARD CLASSIFICATION
CHECK FACTORS WHICH APPLY TO THIS DAM

_____ Located in rural area.
_____ Effective height 35 feet or less.
_____ Height x storage less than 3000.
_____ Downstream development limited to farm buildings, farmland, township, county or
_____ supplementary state roads.
_____ Little or no potential for future downstream development.
_____ Downstream valley is as wide or wider than at dam site.
_____ Hazard classification is class (a).

Signature _____ Date: _____

DESIGN PROCEDURES [1/]

Drainage Area: _____ Acres

1. For Drainage Area 10 acres or less:
Emergency spillway bottom width = 10 ft.
Emergency spillway depth = 1.0 ft. flow depth + 1.0 ft. freeboard = 2 ft.

2. For Drainage Area 11-20 acres:

Circle appropriate data in Tables A thru E and multiply factors in spaces provided below:

Table A	
10 Yr/24 Hr Rainfall	Factor
5.0"	1.9
5.2"	2
5.4"	2.1
5.6"	2.4
5.8"	2.5

Table B	
RCN	Factor
60	0.5
65	0.8
70	1
75	1.3
80	1.5
85	2

Table C	
Watershed Slope	Factor
0-3%	0.7
3-8%	1
8+	1.3

Table D	
Storage Ratio	Factor
10	0.4
15	0.6
20	0.7
30	0.8
40 or more	0.9

Table E	
Aux. Spwy. Flow Depth	Factor
0.5'	1.3
1.0'	0.44
1.2'	0.33
1.5'	0.22

Storage Ratio: Drainage Area / Pool Area = ( ) / ( )

= _____
Round to nearest ratio shown in Table D

Auxiliary Spillway Bottom Width = _____ x _____ x _____ x _____ x _____ x _____
Drainage Area (20 Acre Max) | Table A Factor | Table B Factor | Table C Factor | Table D Factor | Table E Factor

= _____ Ft.; Use _____ Ft.
(10 Ft. Min.)

Auxiliary Spillway Depth = _____ + 1.0 Ft. Freeboard = _____ Ft.
Flow Depth (From Table E)

1/ This design procedure is limited to Class A hazard ponds with drainage area 20 acres or less, effective height 20 feet or less, total height less than 35 feet, no pipe spillway, "Fair" or "Good" auxiliary spillway condition, and 1 to 10% auxiliary spillway exit slope. Trickle tubes may be used. Use Form MO-ENG-40 or Pond Program for larger ponds and structures.

LAYOUT

Landowner _____

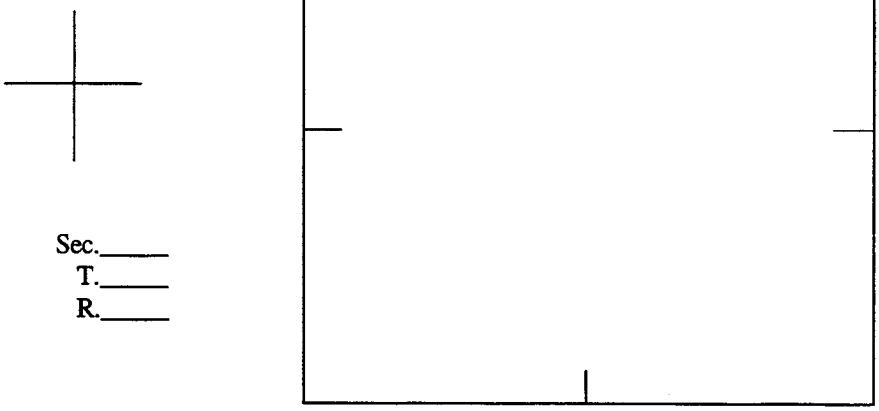
Surveyed by _____ Date _____

Station	B.S.	H.I.	F.S. or grade rod	Top of Dam Elev.	Settled fill ht	Settlement	Slope stakes and remarks

Dam: Elev. Settled Fill: _____ TW: _____ ft. Side slopes: US: _____ DS: _____

Auxiliary Spillway: Crest Elev. _____ Width _____ ft.

_____ % allowed for settlement Staked for (settled) (unsettled) fill height



Sec._____
T._____
R._____

§MO520.25 Clearing Reservoirs

(b)(2)(iii) Inflow channels shall not be cleared upstream beyond the point where the contour representing the crest of the lowest ungated principal spillway inlet remains within the channel banks.

(iv) For land treatment structures (grade stabilization), RC&D-CAT structures, and small floodwater structures (less than 3,000 height x storage) the minimum area to be cleared shall be as stated in 520.25(b)(2)(ii). The 400 feet shown in 520.25(b)(2)(ii) shall be from principal spillway inlet.

MO520.28 Potential impact area—class (a) dams of inventory size and all class (b) dams.

(b) Requirements.

(3) Use Form MO-ENG-C82 to document the impact area and a letter similar to Exhibit in MO520.28 to inform the landowner. Other forms or maps are acceptable if they show the same information.

(4) Use breach routing procedures for all class (b) dams.

(5) The following procedures will be used in class (a) inventory size dams.

(i) The person who approves the design drawings will determine that the proper method was used to define the impact area. Breach routing or a conservative approximation may be used.

(ii) A conservative approximation normally used would be the area defined using data from the charts in Appendix B of Missouri Engineering Technical Note 9 for those sites meeting the applicable conditions.

(6) Advise owners that the hazard classification and design should be re-evaluated if there is development or changes in the impact area.

(c) Distribution.

(3) The description and/or maps of the potential impact area shall be submitted to the landowner or sponsor. It is the responsibility of the landowner or sponsor to transmit the description of potential impact area to:

(i) All landowners involved.

(ii) The local Soil and Water Conservation District.

(iii) The Missouri Dam and Reservoir Safety Program if the overall height is 35 feet or greater.

(iv) Any local government agency having zoning authority on the potential impact area.

(4) If requested by the owner or sponsor, or if the owner or sponsor fails to act, NRCS shall distribute this information. The responsibility for distributing this information is delegated to the district conservationist by the state conservationist.

USDA NRCS
Natural Resources Conservation Service
<Name of Office>
<Address of NRCS office>
<City, State Zip of NRCS office>
<NRCS Office phone number>

<Date>

<Name>
<Address>
<City>, <State> <Zip code>

<Salutation>:

The Natural Resources Conservation Service (NRCS) has designed a dam on your property. The location, size, and other significant features regarding the dam are shown on the attached form.

The form shows information used to evaluate the area that would be flooded or impacted should there be a sudden failure of the dam. The hazard class and design were based on this information. The hazard classification and design should be re-evaluated if changes are made in the impact area downstream from the dam or in the watershed upstream of the dam.

Dam failures are rare and most failures are not of the sudden, catastrophic type. The NRCS believes your dam will serve you for many years. However, this information on the potential hazard in case of sudden failure is being furnished so everyone affected by the construction of this dam can be properly informed.

A copy of this letter and form are being sent to your local Soil and Water Conservation District and any local government agency having zoning authority on the potential impact area for their information. If the dam is 35 feet or greater in overall height, the Missouri Dam and Reservoir Safety Program will be sent a copy for their information.

Please contact me if you have questions or desire further information.

Sincerely,

<NRCS Employee Name>

District Conservationist

Attachments: Form MO-ENG-C82, MO-ENG-C46 or MO-ENG-46

Cc: _____ Soil and Water Conservation District
Local agency having zoning authority on potential impact area
Missouri Dam and Reservoir Safety Program (Only if dam is 35 feet or greater in height.)